Optional Price 20 cents

RCA

COS/MOS

A Broad Line of Digital Integrated Circuits

COS 277 Printed in U.S.A. 1-71

COS/MOS INTEGRATED CIRCUITS

For High Noise Immunity, Low-Power Digital-Circuit Designs.

The COS/MOS* IC's described in this Product Guide offer the equipment designer a comprehensive and fast-growing line of digital circuits—Gates, Shift Registers, Counter/Dividers, Decoders, Adders, Flip-Flops, Hex Buffer/Logic-Level Converters, Multiplexers, Memories —for use in a wide variety of logic system designs where low power dissipation and high noise immunity are primary circuit requirements.

The inherent advantages of these COS/MOS IC's over other logic devices (see features right) permit the systems design engineer to achieve outstanding performance, high reliability, simplified circuitry, plus excellent systems economies in a wide variety of line or battery-operated equipment including—

automotive equipment
avionics
communications equipment
data terminals
instrumentation
alarm systems
computers
industrial controls
remote metering
timers, clocks, watches
appliances

and in other commercial, industrial, and consumer applications.

* Complementary-Symmetry Metal-Oxide-Semiconductor.

Maximum Ratings (Absolute-Maximum Values):

	CD4000, D Series	CD4000E Series
STORAGE TEMPERATURE RANGE	−65°C to +150°C	−65°C to +150°C
OPERATING TEMPERATURE RANGE	−55°C to +125°C	−40°C to + 85°C
DC SUPPLY VOLTAGE RANGE (V_{DD}-V_{SS})	0.5V to +15V	0.5V to +15V
DEVICE DISSIPATION (per pkg)	200 m W	200 m W
ALL INPUTS	$V_{SS} \leq V_I \leq V_{DD}$	$V_{SS} \leq V_I \leq V_{DD}$
Minimum Recommended		
DC Supply Voltage (V_{DD}-V_{SS})	6V	5V
For Developmental Types TA5938, TA5939, TA5987	1.5V	

Developmental-type devices or materials are intended for engineering evaluation. The type designation and data are subject to change, unless otherwise arranged. No obligations are assumed for notice of change or future manufacture of these devices or materials.

Information furnished by RCA is believed to be accurate and reliable. However, no responsibility is assumed by RCA for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of RCA.

Features —

- wide operating temperature range:

	CD 4000, D Series	CD 4000E Series
	−55°C to+125°C	−40°C to+85°C

- low quiescent device dissipation/package (P_T):

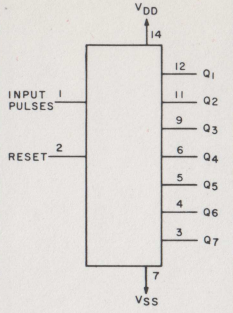
Gates	(V_{DD}= @ 10V)	10 nW typ/pkg	50 nW typ/pkg
MSI Circuits		5μW typ/pkg	10 μW typ/pkg

- speed:

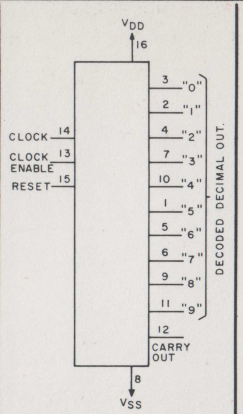
Gates (tpd)	50 ns typ
MSI Circuits (f_{CL})	3 MHz typ

- wide operating supply voltage range— **5 to 15 volts,** with ultra-low-power types operating at **1.5** volts.
- high dc and dynamic noise immunity— **45%** of V_{DD}, insures high tolerance to external noise or input signal variations in logic systems.
- high tolerance to temperature variations— excellent stability over full operating temperature range.
- single phase clock— simplifies timing considerations.
- clock voltage swings equal to supply voltage— same power source used for clock and logic voltage.
- input protection circuits— all inputs protected against electrostatic effects.
- high fanout— > 50.
- wide variety of ceramic and plastic packages.

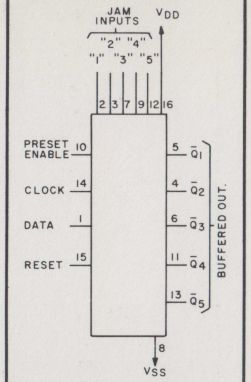
COUNTER/ DIVIDERS



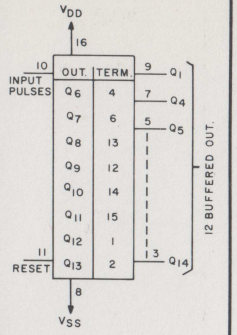
CD4004,D,T CD4004E
7-Stage
Binary Counter
Ripple-Carry Type



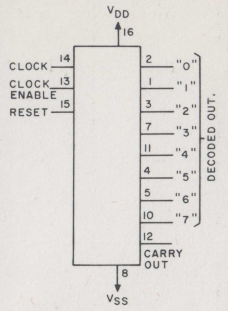
CD4017, D CD4017E
Decade Counter/
Divider Plus 10
Decoded Decimal
Outputs



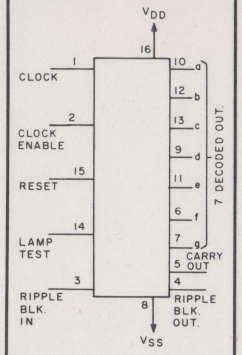
CD4018, D CD4018E
Presettable,
Divide-by-"N"
Counter
Fixed or Programmable
Divide by 2 through 10



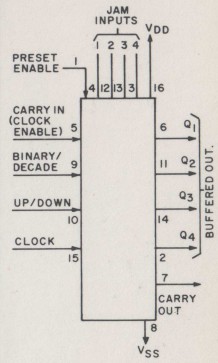
CD4020, D CD4020E
14-Stage Binary
Counter/Divider
Ripple-Carry Type



TA5884
Divide-by-8
Counter/Divider
with 8 Decoded
Outputs



TA5677
Decade Counter/
Divider with 7-
Segment Display
Outputs



TA5925
Presettable,
Up/Down Counter,
Binary or BCD-
Decade

Typical Electrical Characteristics
T_A=25°C, V_{DD}=10V, V_{ss}=0V
Unless Otherwise Specified

	CD4004,D,T	CD4004E	CD4017,D	CD4017E	CD4018,D	CD4018E	CD4020,D	CD4020E	TA5884	TA5677	TA5925
STATIC											
DC Input Current (I_I)—nA	10pA	10	10	10	10	10	10	10	10	10	10
Quiescent Device Dissipation Per Package (P_D)—μW	5	10	5	10	5	10	10	20	5	5	5
Output Voltage "O" (V_o"O")—V	0	0	0	0	0	0	0	0	0	0	0
Output Voltage "I" (V_o"I")—V	10	10	10	10	10	10	10	10	10	10	10
Noise Immunity —V	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Output Drive Current•(I_o"O")—mA	+1.7*	+1.7*	+0.8, +3	+0.8, +3	+1, +3	+1, +3	+2.2	+2.2	+0.8, +3	+0.7	+10, +1.6
Output Drive Current•(I_o"I")—mA	−1.3#	−1.3#	−0.5, −3	−0.5, −3	−1, −3	−1, −3	−1.5	−1.5	−0.5, −3	−2	−4, −2
DYNAMIC											
Av Input Capacitance (C_I)—pF	$C_{IN}\theta$ = 3.5										
	C_{INR} = 40		3	3	3	3	3	3	3	3	3
Speed (f_{CL})—MHz	2	2	3	3	3	3	2.5	2.5	2.5	2.5	2.5
Propagation Delay "O"(t_{pd} "O")-ns	175	175	225	225	225	225	150	150	225	300	200
Propagation Delay "I"(t_{pd} "I")-ns	190	190	300	300	275	275	150	150	200	300	200
Transition Time "O" ($t_{,,o,,}$)—ns	150	150	100	100	75	75	100	100	225	200	—
Transition Time "I" ($t_{,,I,,}$)—ns	225	225	200	200	175	175	100	100	200	200	—
Clock Pulse: Max.Rise&FallTimes (tr_{CL}=/t_{fCL})—ns	15	15	15	15	5 min	5 min	15	15	15	15	15
PACKAGE	FP, DIC, TO-5	DIP	FP, DIC	DIP	FP, DIC	DIP	FP, DIC	DIP	16-Lead	16-Lead	16-Lead
For Additional Data Refer to Data Bulletin File No.....	347	445	428	445	438	445	446	445	"TA" Data	"TA" Data	"TA" Data

•V_o"I"=7V, V_o"O"=3V

#V_{GS} = 10V, V_{DS} = −2V *V_{GS} = 10V, V_{DS} = 1.5V

FP = Flat Pack, DIC = Dual In-line Ceramic, DIP = Dual In-line Plastic

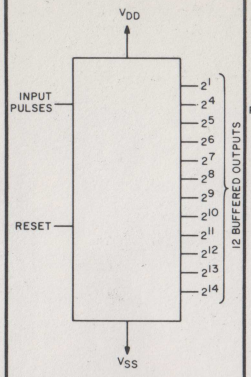
Type numbers with "TA" prefix are developmental types.

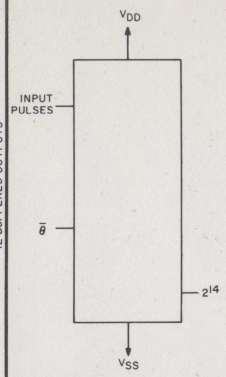
COUNTER/ DIVIDERS (cont'd)

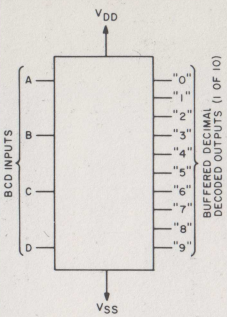
DECODERS

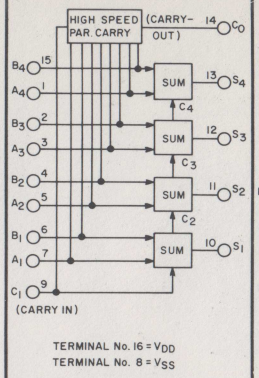
ADDERS

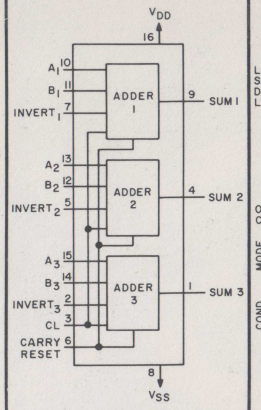
Typical Electrical Characteristics
T_A=25°C, V_{DD}=10V, V_{ss}=0V
Unless Otherwise Specified

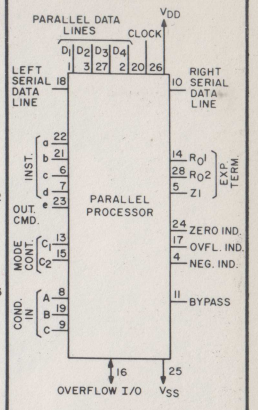












	TA5938 Ultra-Low-Power, 14-Stage, Ripple Carry Binary Counter/Divider (V_{DD} = 1.5V)	TA5939 Ultra-Low-Power, 14-Stage, Ripple Carry Binary Counter/Divider (V_{DD} = 1.5V)	TA5873 BCD-to-Decimal Decoder	CD4008, D CD4008E Four Bit Full Adder with Parallel Carry Out		TA5963 Triple Serial Adder with Common Clock & Carry Reset Inputs	TA5716 Parallel Processor
	TA5938	**TA5939**	**TA5873**	**CD4008, D**	**CD4008E**	**TA5963**	**TA5716**
STATIC							
DC Input Current (I_I)—nA	1	Typical Customized Version of TA5938 featuring reduced operating power consumption made possible by— (1) eliminating reset function and using only 1 output from stage 14, and (2) a separate terminal to permit optional driving from a crystal oscillator	10	10	10	10	10
Quiescent Device Dissipation Per Package (P_D)—μW	25 nw		4.5	5	0.05	5	—
Output Voltage "O" (V_o"O")—V	0		0	0	0	0	0
Output Voltage "I" (V_o"I")—V	1.5		10	10	10	10	10
Noise Immunity —V	0.675		4.5	4.5	4.5	4.5	4.5
Output Drive Current •(I_o"O")—mA	+0.1*		+8	+4, +0.4	+4, +0.4	+5.4	+0.95
Output Drive Current •(I_o"I")—mA	−0.1**		−8	−4, −0.2	−4, −0.2	−4	−0.8
DYNAMIC							
Av Input Capacitance (C_I)—pF	3		3	10	10	3	3
Speed (f_{CL})—MHz	100 kHz		—	Sum-Out = 400 Lines Carry-Out = 50 Lines		—	—
Propagation Delay "O"(t_{pd} "O")-ns	—		350			150	Sum-Out Lines— 1, 5, 2
Propagation Delay "I"(t_{pd} "I")-ns	—		350	—	—	150	Carry-Out Lines— 1.2, 0.5
Transition Time "O" (t_{t_o})—ns	—		100	—	—	75	
Transition Time "I" (t_{t_I})—ns	—		100	—	—	75	—
Clock Pulse: Max. Rise&Fall Times (t_{rCL} = / t_{fCL})—ns	15 μs		—	—	—	15	—
PACKAGE	16-Lead	16-Lead	16-Lead	FP, DIC	DIP	16-Lead	28-Lead
For Additional Data Refer to Data Bulletin File No.....	"TA" Data	"TA" Data	"TA" Data	405	445	"TA" Data	"TA" Data

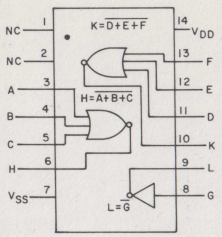
•V_o"I"=7V, V_o"O"=3V

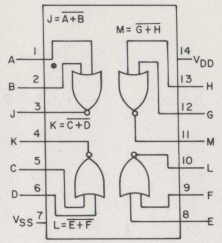
* V_o "O" =.5 V, ** V_o "I" = 1.0 V
FP = Flat Pack, DIC = Dual In-line Ceramic, DIP = Dual In-line Plastic

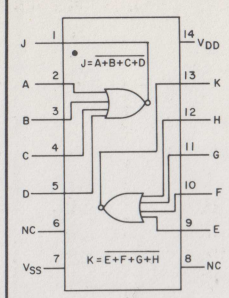
Type numbers with "TA" prefix are developmental types.

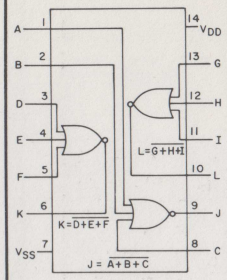
GATES:

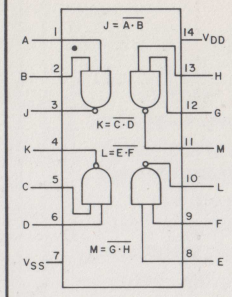
NOR
NAND

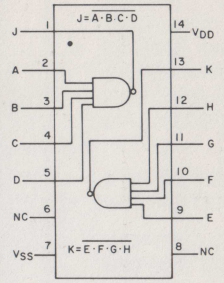


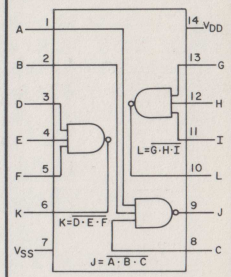












Typical Electrical Characteristics
T_A=25°C, V_{DD}=10V, V_{ss}=0V
Unless Otherwise Specified

	CD4000, D CD4000E Dual 3-Input NOR Gate Plus Inverter		CD4001, D CD4001E Quad 2-Input NOR Gate		CD4002, D CD4002E Dual 4-Input NOR Gate		TA5920 Triple 3-Input NOR Gate	CD4011, D CD4011E Quad 2-Input NAND Gate		CD4012, D CD4012E Dual 4-Input NAND Gate		TA5867 Triple 3-Input NAND Gate
	CD4000,D	**CD4000E**	**CD4001,D**	**CD4001E**	**CD4002,D**	**CD4002E**	**TA5920**	**CD4011,D**	**CD4011E**	**CD4012,D**	**CD4012E**	**TA5867**
STATIC												
DC Input Current (I_I)—nA	10pA	10	10pA	10	10pA	10	10	10	10	10	10	10
Quiescent Device Dissipation Per Package (P_D)—μW	0.01	0.05	0.01	0.05	0.01	0.05	0.01	0.01	0.05	0.01	0.05	0.01
Output Voltage "O" (V_o"O")—V	0	0	0	0	0	0	0	0	0	0	0	0
Output Voltage "I" (V_o"I")—V	10	10	10	10	10	10	10	10	10	10	10	1.5
Noise Immunity —V	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.675
Output Drive Current •(I_o"O")—mA	+5.4	+5.4	+5.4	+5.4	+5.4	+5.4	+6	+6	+6	+3	+3	+6
Output Drive Current •(I_o"I")—mA	−4	−4	−4	−4	−4	−4	−4	−6	−6	−6	−6	−6
DYNAMIC												
Av Input Capacitance (C_I)—pF	5	5	5	5	5	5	5	5	5	5	5	5
Speed (C_L=15pF) (t_{pd})—ns	50	50	50	50	50	50	50	50	50	50	50	50
Propagation Delay "O"(t_{pd} "O")—ns	65	65	65	65	65	65	65	65	65	130	130	65
Propagation Delay "I"(t_{pd} "I")—ns	100	100	100	100	100	100	100	80	80	80	80	80
Transition Time "O" ($t_{,,o,,}$)—ns	125	125	125	125	125	125	125	130	130	260	260	130
Transition Time "I" ($t_{,,I,,}$)—ns	200	200	200	200	200	200	200	160	160	160	160	160
PACKAGE	FP, DIC	DIP	FP, DIC	DIP	FP, DIC	DIP	14-Lead	FP, DIC	DIP	FP, DIC	DIP	14-Lead
For Additional Data Refer to Data Bulletin File No.....	345	445	345	445	345	445	"TA" Data	420	445	420	445	"TA" Data

•V_o"I"=7V, V_o"O"=3V

FP = Flat Pack, DIC = Dual In-line Ceramic, DIP = Dual In-line Plastic

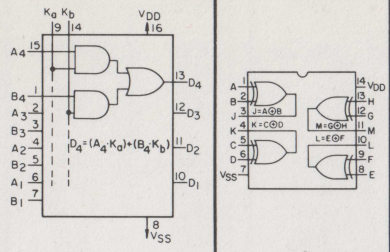
Type numbers with "TA" prefix are developmental types.

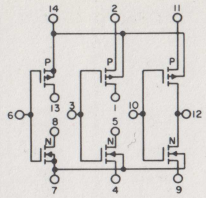
GATES: (cont'd)

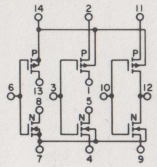
Comp. Pairs

AND/OR Select

Exclusive-OR







Typical Electrical Characteristics
T_A=25°C, V_{DD}=10V, V_{ss}=0V
Unless Otherwise Specified

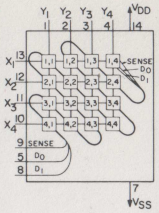
	CD4019, D CD4019E Quad AND-OR Select Gate		TA5940 Quad Exclusive-OR Gate	CD4007, D CD4007E Dual Complementary Pair Plus Inverter		TA5987 Ultra-Low-Power Dual, Complementary Pair, Plus Inverter (V_{DD} = 1.5V)
	CD4019,D	**CD4019E**	**TA5940**	**CD4007,D**	**CD4007E**	**TA5987**
STATIC						
DC Input Current (I_I)—nA	10	10	10	10 pA	10	1
Quiescent Device Dissipation Per Package (P_D)—μW	0.5	0.2	0.1	0.01	0.05	15 nW
Output Voltage "O" (V_o"O")—V	0	0	0	0	0	0
Output Voltage "I" (V_o"I")—V	10	10	10	10	10	10
Noise Immunity —V	4.5	4.5	4.5	4.5	4.5	4.5
Output Drive Current•(I_o"O")—mA	+5.5	+5.5	+6	+5.4	+5.4	+0.05■
Output Drive Current •(I_o"I")—mA	−5	−5	−4	−11.8	−11.8	−0.05■■
DYNAMIC						
Av Input Capacitance (C_I)—pF	3, 12	3, 12	3	5	5	2
Speed (C_L=15pF) (tpd)—ns	100	100	100	35	35	
Propagation Delay "O" (t_{pd} "O")-ns	100	100	100	150	150	100
Propagation Delay "I" (t_{pd} "I")-ns	100	100	100	200	200	100
Transition Time "O" (t_{t_o})—ns	75	75	75	200	200	75
Transition Time "I" (t_{t_I})—ns	75	75	75	200	200	75
PACKAGE						
For Additional Data Refer to Data Bulletin File No.	FP, DIC 439	DIP 445	14-Lead "TA" Data	FP, DIC 349	DIP 445	14-Lead "TA" Data

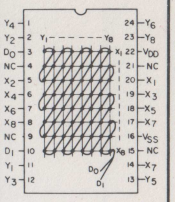
•V_o"I"=7V, V_o"O"=3V

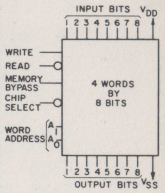
■V_o"O" = 0.5 V ■■V_o"I" = 1.0 V

FP = Flat Pack, DIC = Dual In-line Ceramic, DIP = Dual In-line Plastic

MEMORIES:





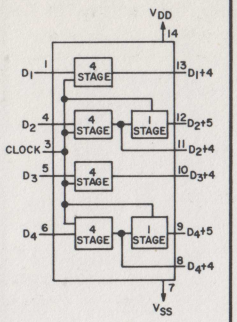


	CD4005, D 16-Bit NDRO Static RAM X-Y Select	TA5577 NDRO Static RAM X-Y Select	TA5926 4 Words × 8 Bits Word Organized
	CD4005,D	**TA5577**	**TA5926**
Static			
DC Input Current (I_I)—nA	1	0.1 μA	10
Quiescent Device Dissipation Per Package (P_D)—μW	100 mW	30	10
Data Line Current, Sense "O"—μA	10	0.5	Logic Level
Data Line Current, Sense "I"—μA	1000	300	Sensing Used
Data Input Current (I_{DO}=)—μA (I_{DI})	1000	—	—
Av. Capacitance to Ground:			
Each Data Line (C_D)—pF	10	10	[All Inputs =3]
Any X Address Line (C_z)—pF	20	15	
Any Y Address Line (C_y)—pF	20	5	
Dynamic			
Readout Delay Time:			
Read After Read (t_{rd})—ns	15	50	100
Read After Write (t_{rw})—ns	15	300	100
Write Pulse Duration—ns	50	100	250
Write Setup Time—ns	—	—	—
Write Removal Time—ns	—	30	100
	FP, DIC	24-Lead	24-Lead
	348	"TA" Data	"TA" Data

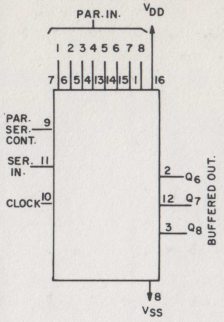
Type numbers with "TA" prefix are developmental types.

Type numbers with "TA" prefix are developmental types.

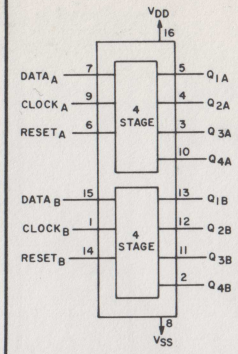
STATIC SHIFT REGISTERS



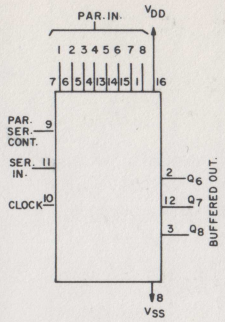
CD4006, D CD4006E
18-Stage



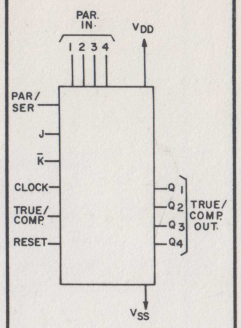
CD4014, D CD4014E
8-Stage Synch. Parallel Input/ Serial Output



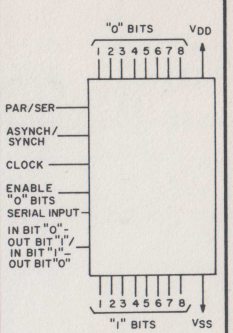
CD4015, D CD4015E
Dual 4-Stage with Serial Input/ Parallel Output



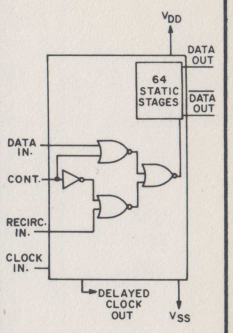
CD4021, D CD4021E
8-Stage Asynch. Parallel Input/ Serial Output



TA5876
4-Bit Parallel/Serial with J-K Input and True Complement Output



TA5878
8-Bit Bidirectional Parallel/Serial, Input/Output Bus



TA5989
64-Stage

Typical Electrical Characteristics

T_A=25°C, V_{DD}=10V, V_{ss}=0V
Unless Otherwise Specified

	CD4006,D	CD4006E	CD4014,D	CD4014E	CD4015,D	CD4015E	CD4021,D	CD4021E	TA5876	TA5878	TA5989
STATIC											
DC Input Current (I_I)—nA	10	10	10	10	10	10	10	10	10	10	10
Quiescent Device Dissipation Per Package (P_D)—μW	5	10	5	10	5	10	5	10	10	10	10
Output Voltage "O" (V_o"O")—V	0	0	0	0	0	0	0	0	0	0	0
Output Voltage "I" (V_o"I")—V	10	10	10	10	10	10	10	10	10	10	10
Noise Immunity —V	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Output Drive Current •(I_o"O")—mA	+0.8	+0.8	+1.0	+1.0	+1.0	+1.0	+1.0	+1.0	+5.4	+0.5	+10▲
Output Drive Current •(I_o"I")—mA	−1.0	−1.0	−1.0	−1.0	−1.0	−1.0	−1.0	−1.0	−4.1	−0.8	−1.2△
DYNAMIC											
Av Input Capacitance (C_I)—pF	C_{data} = 3 C_{clock} = 30		3	3	3	3	3	3	3	3	C_{IN} = 3 C_{CL} = 70
Speed (f_{CL})—MHz	2	2	2.5	2.5	3	3	2.5	2.5	2.5	2.5	5
Propagation Delay "O" (t_{pd}"O")—ns	150	150	250	250	250	250	250	250	250	250	200
Propagation Delay "I" (t_{pd}"I")—ns	200	200	250	250	250	250	250	250	250	250	200
Transition Time "O" (t_{t_o})—ns	200	200	125	125	125	125	125	125	125	200	200
Transition Time "I" (t_{t_I})—ns	200	200	125	125	125	125	125	125	125	200	200
Clock Pulse: Max. Rise&Fall Times (t_{rCL} = / t_{fCL})—μs	0.4	0.4	15	15	15	15	15	15	15	15	1.0
PACKAGE	FP, DIC	DIP	FP, DIC	DIP	FP, DIC	DIP	FP, DIC	DIP	16-Lead	24-Lead	16-Lead
For Additional Data Refer to Data Bulletin File No.....	384	445	415	445	416	445	447	450	"TA" Data	"TA" Data	"TA" Data

•V_o"I"=7V, V_o"O"=3V

△ at V_o"I" = 9.5 V ▲ at V_o"O" = 0.5 V

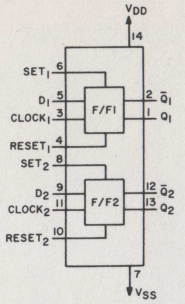
FP = Flat Pack, DIC = Dual In-line Ceramic, DIP = Dual In-line Plastic

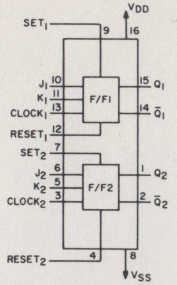
Type numbers with "TA" prefix are developmental types.

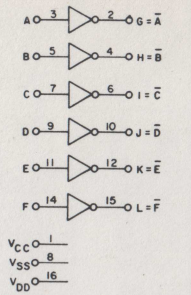
FLIP-FLOPS

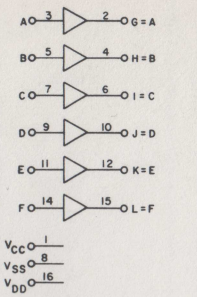
HEX-BUFFER/ Logic-Level Converters

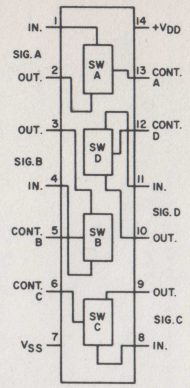
MULTIPLEXERS











Typical Electrical Characteristics
T_A=25°C, V_{DD}=10V, V_{ss}=0V
Unless Otherwise Specified

	CD4013, D CD4013E Dual "D" with Set/Reset Capability		TA5872 Dual J-K Master Slave with Set/Reset Capability	CD4009, D CD4009E Inverting Type (V_{DD} = 10V, V_{CC} = 5V)		CD4010, D CD4010E Non-Inverting Type (V_{DD} = 10V, V_{CC} = 5V)		CD4016, D CD4016E Quad Bilateral Switch	
	CD4013, D	**CD4013E**	**TA5872**	**CD4009, D**	**CD4009E**	**CD4010, D**	**CD4010E**	**CD4016, D**	**CD4016E**
STATIC									
DC Input Current (I_I)—nA	10	10	10	10pA	10pA	10pA	10pA		
Quiescent Device Dissipation Per Package (P_D)—μW	0.05	0.2	0.05	0.1	5	0.1	5	0.1	0.1
								All Switches "Off & On"	
Output Voltage "O" (V_o"O")—V	0	0	0	0	0	0	0	—	
Output Voltage "I" (V_o"I")—V	10	10	10	5	5	5	5	"ON" Resistance	
Noise Immunity —V	4.5	4.5	4.5	4.5	4.5	4.5	4.5	300 Ω(V_{IS} = +5V)	
								280 Ω(V_{IS} = −5V)	
Output Drive Current (I_o"O")—mA	+5.4•	+5.4•	+5.4•	+12*	+12*	+12*	+12*	—	
Output Drive Current (I_o"I")—mA	−4.1•	−4.1•	−4.1•	−1*	−1*	−1*	−1*	Leakage Current (Input or Output) Switches "Off"	
DYNAMIC									
Av Input Capacitance (C_I)—pF	5	5	5	5.5	5.5	5.5	5.5	±10pA(V_{IS} = ±5V)	
								—	
Speed	2.5	2.5	2.5	—	—	—	—	Turn-"On"	
Propagation Delay "O" (t_{pd} "O") -ns	190	190	200	25	25	30	30	Propagation Delay	
Propagation Delay "I" (t_{pd} "I") -ns	190	190	200	50	50	40	40	tpdC = 20ns	
Transition Time "O" ($t_{,,o,,}$)—ns	90	90	—	110△	110△	110△	110△	—	
Transition Time "I" ($t_{,,I,,}$)—ns	130	130	—	400△	400△	400△	400△	Max Allowable Control Input Repetition Rate: 10MHz	
Clock Pulse:									
Max. Rise & Fall Times —μs	5	5	15	—	—	—	—		
PACKAGE	FP, DIC	DIP	16-Lead	FP, DIC	DIP	FP, DIC	DIP	FP, DIC	DIP
For Additional Data Refer to Data Bulletin File No.....	411	445	"TA" Data	393	445	394	445	444	445

•V_o"I"=7V, V_o"O"=3V

△ Maximum. *V_o "I" = 4.5V, V_o"O" = 0.5V

FP = Flat Pack, DIC = Dual In-line Ceramic, DIP = Dual In-line Plastic

Type numbers with "TA" prefix are developmental types.

COS/MOS Application Notes—

ICAN-5593 Complementary MOS Transistor Logic Integrated Circuits

ICAN-6176 Noise Immunity of COS/MOS Integrated Circuit Logic Gates

ICAN-6218 Gate-Oxide Protection Circuit in RCA COS/MOS Digital Integrated Circuits

ICAN-6267 Astable and Monostable Oscillators Using RCA COS/MOS Digital Integrated Circuits

ICAN-6498 Design of Fixed and Programmable Counters Using RCA-CD4018 Presettable Divide-by-"N" Counter

COS/MOS Reports

RIC-101 RCA COS/MOS IC Reliability Data

RIC-103 COS/MOS CD4000E Series Reliability Data

For additional information on RCA COS/MOS Digital Integrated Circuits and other Digital Circuits, contact your RCA Sales Representative or write to RCA/Commercial Engineering/Harrison, N. J. 07029